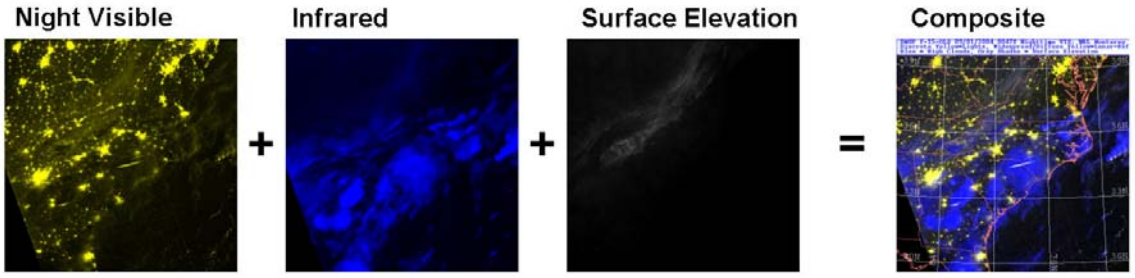
Headliner!

Military Weather Satellite Images now Available to Public in Near-Realtime

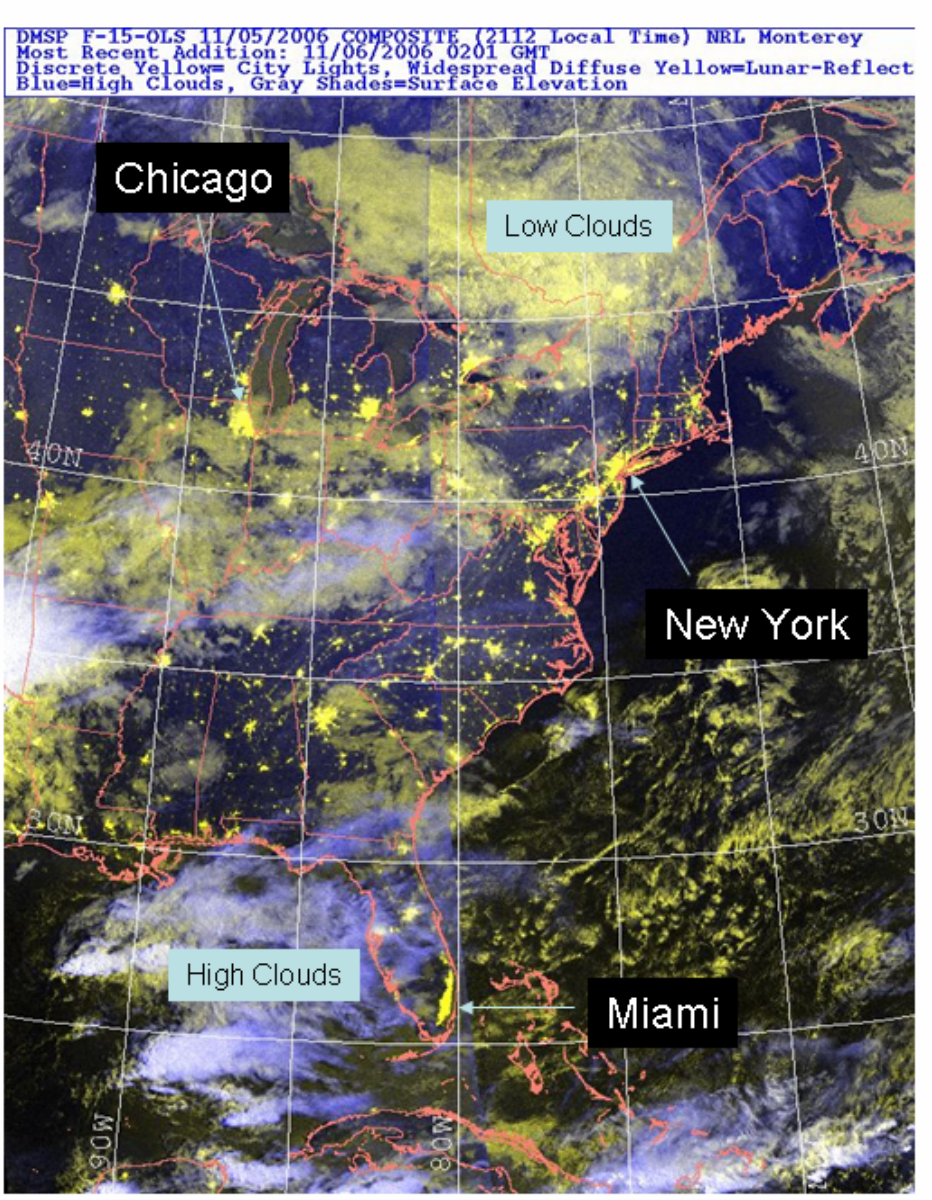
December 14 2006

The *Defense Meteorological Satellite Program (DMSP)* has flown a nighttime visible capability since the 1970's on its polar-orbiting satellites. Designed specifically to enhance the very low levels of visible light present at night, the instrument was placed in orbit to see nighttime clouds otherwise undetectable using infrared sensors. Reportedly, the Air Force officers examining the first images were amazed to see tiny dots of lights which represented cities over the entire globe. The sensor can detect many other types of light as well, including those from fires, lightning, lava flows, the aurora, gas flares, and even a kind of bioluminescence, known as "milky seas". For years only US military personnel were allowed to view these images in near-realtime. Now NexSat displays nighttime visible images for the general public over the entire continental United States and Hawaii, subject only to a three hour delay after imaging.

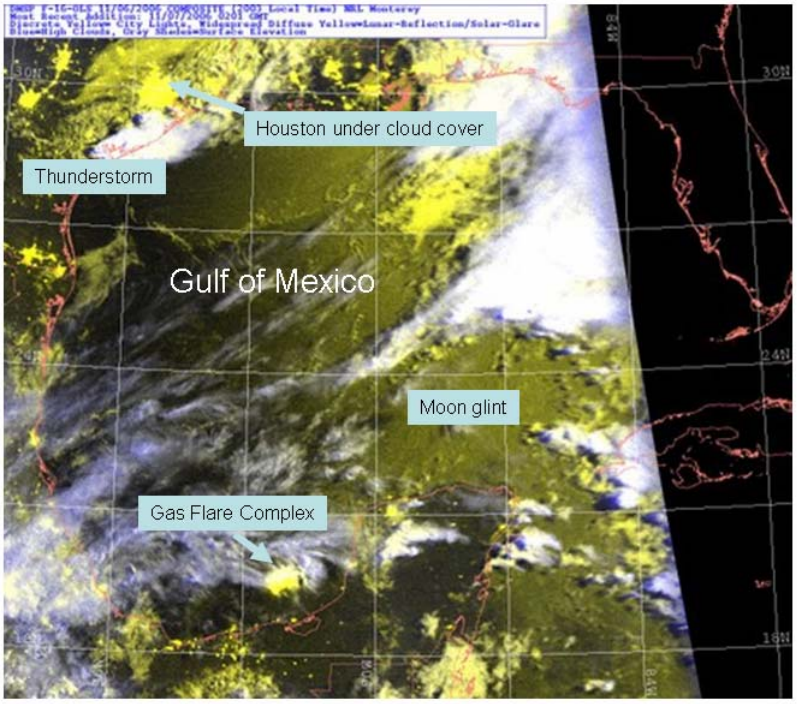
The image product featured on NexSat is a composite combining information about low clouds and city lights (from visible channel), high clouds and thunderstorms (from infrared channel), and surface elevation (terrain data base). These three pieces of information are combined into a false-color composite depicting terrain features in black/white, surface lights and low clouds as yellow, and high (cold) clouds as blue, as shown in the illustration below. Low cloud cover only appears when there is sufficient lunar illumination. The composite shows high clouds in blue, low clouds in yellow, and a number of other phenomena as explained below.



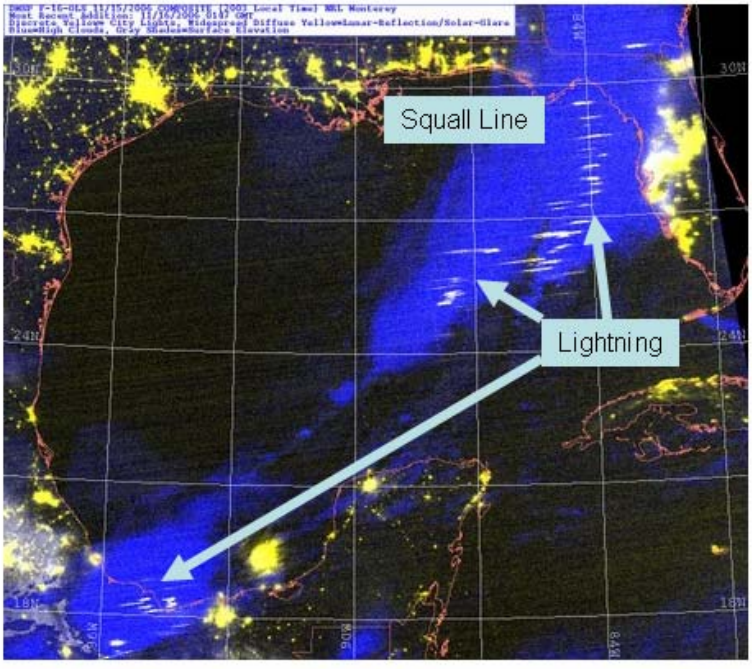
The image below shows a typical composite from the NRL NexSat page over the US East Coast. Notice the striking depiction of cities of all sizes. The moon is full, providing excellent illumination for low clouds. For low clouds to appear the moon must be quarter full or more and positioned well above the horizon. As we shall see, however, many features can be seen in these images even when lunar illumination is absent.



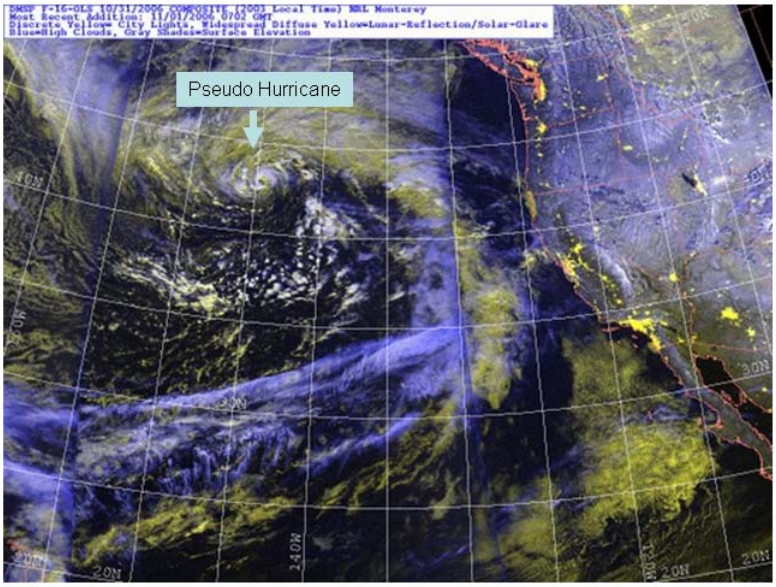
The image below shows an extraordinary amount of detail over the Gulf of Mexico. The city of Houston can be seen even under cloud cover. In the southern Gulf we can observe gas flares from a complex of offshore oil platforms. Much of the Gulf is covered with moon glint, a specular reflection of the moon off the surface of the ocean . Many users are familiar with sun glint which appears during the daytime, produced by solar reflection off the surface of the ocean and other water bodies. Moon glint is the same phenomenon at night.



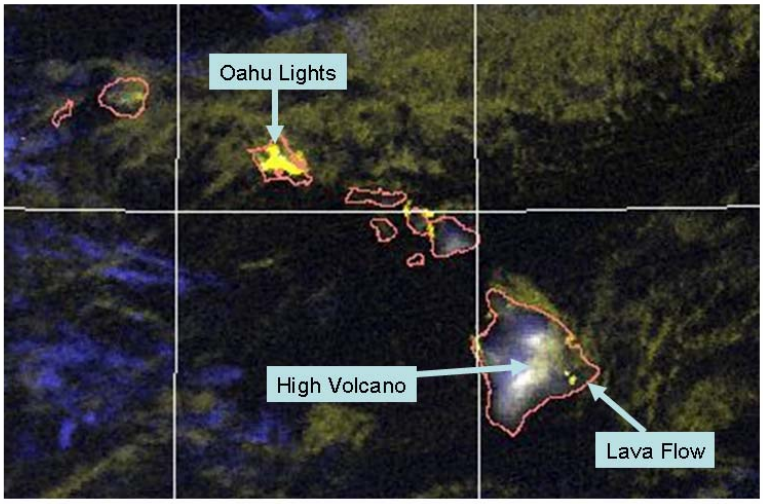
Often long white streaks can be seen in images revealing the locations of intense electrical activity. We can see, for example, the locations of embedded convection along a nocturnal squall line in the image below within the Gulf of Mexico.



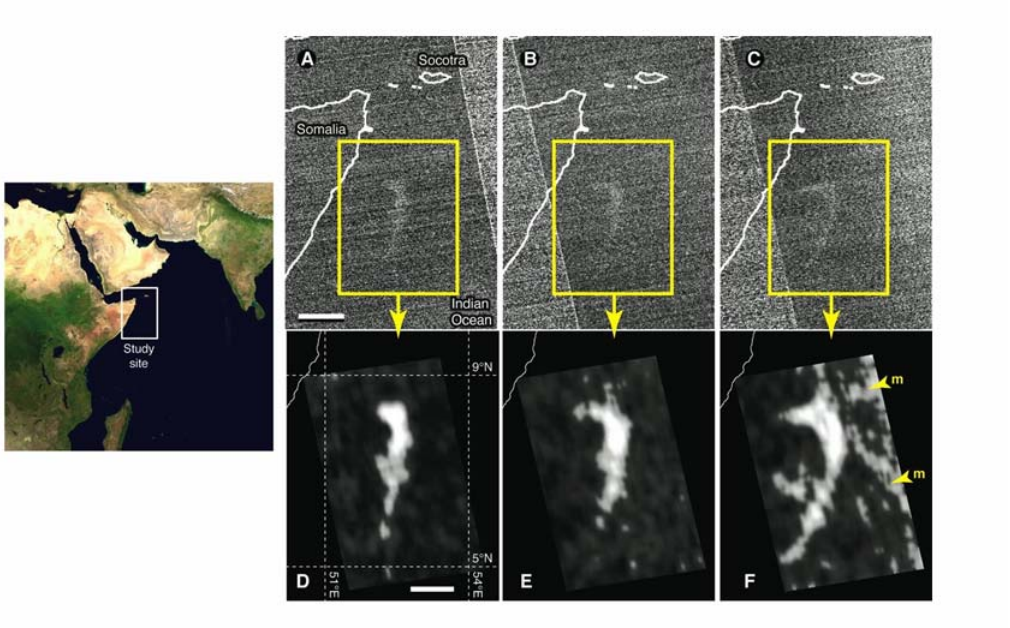
Nighttime visible composites can sometimes show remarkable images of tropical cyclones. The storm in the image below is not a tropical cyclone, but has many of the same characteristics, for example, a storm eye and concentric bands. Notice the ability of the product to distinguish low clouds in yellow from high clouds in cyan. Deep cold clouds, including those of the "pseudo hurricane", appear in white.



Nighttime visible images can be used over small regions to detect very local phenomena. In the example below, Oahu is the only one of the Hawaiian Islands that shows much evidence of city lights. On the big island the whitesh color in the center indicates high elevation, and the tiny yellow dots on the eastern end spotlight molten lava flows!



The DMSP nighttime visible is perhaps the most underutilized environmental satellite capability available today. Did you know it can detect bioluminescence at night under conditions of no moon? In the example below of the Indian Ocean (colored map below) a faint bright area was detected three nights in a row (top row of black and white images). Computer processing enhanced the images (bottom row), and a ship in the area collaborated the "milky seas" bioluminescence.



In the NPOESS era the VIIRS sensor will have an improved version of the nighttime visible channel called the Daynight (DNB) band. It will have greater sensitivity, reduced footprint size for improved detail, and many more display gray shades.

More Information

To see these products on the NexSat website, select the Night Vis button on the menu frame on the left on: http://www.nrlmry.navy.mil/NEXSAT.html

For a COMET educational module on nighttime visible products go to: http://meted.ucar.edu/npoess/viirs/

PNAS article on Milky Seas Detection: http://www.pnas.org/cgi/content/full/102/40/14181